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Epidemiological insights on the association between female genital mutilation and Hepatitis C Infection in Egypt: An Examination using Demographic and Health Survey data of Egypt, 2008.

Shameem F. Jabbar

ABSTRACT

Purpose: Egypt has the highest prevalence of chronic Hepatitis C virus (HCV) infections and also a high prevalence of female genital mutilation (FGM). The high prevalence chronic hepatitis C has been attributed to HCV transmission by contaminated injections for the control of schistosomiasis. HCV infection has not been well studied in the context of female genital mutilation (FGM). We sought to identify associations between FGM and HCV using the Egypt Demographic and Health Survey (EDHS), 2008.

Methods: FGM was chosen as the main independent variable of interest. Other independent variables such as age, education, marital status, residence, beliefs associated with FGM, history of blood transfusion, surgery, sharing needles, and history of schistosomiasis were included in the analysis. Throughout the analysis, HCV infection was used as the main dependent variable.

Results: Univariate analysis of FGM and HCV showed a statistically significant association with a Prevalence Odds Ratio of 4.82 (2.91 -7.96), after adjusting for age and schistosomiasis injection, the association between FGM and HCV remained statistically significant with an odds of 2.98 (1.76 – 5.05)Among the category for FGM performer and association with HCV infection, the OR was 4.28 (2.31 – 7.91) when the FGM was performed by a ghagaria, 3.68 (2.76 - 4.90) when the FGM was performed by daya, and 3.30 (1.81 -5.88) when the FGM was performed by a barber. Among other independent variables, a lack of education, rural residence, and having religious precepts for FGM had statistically increased odds of association with HCV infection.

Conclusion: There is a statistically significant association between FGM and HCV infection. There are increased odds of HCV when the FGM is performed by providers other than doctors. Participants from a rural residence and who those who did not have any education were at increased odds of HCV. Subjects who believed in religious precepts for FGM and also who answered that FGM can continue had increased odds of association with HCV infections.

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Submitted to Georgia State University as a partial fulfillment for the Degree of Masters in Public Health

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DEDICATION PAGE

The following thesis document is dedicated to my family for their constant support and love.

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Chapter I

Introduction

1a. Background

Globally, the World health Organization (WHO) estimates that each year 3-4 million people are newly infected with Hepatitis C virus (HCV); 150 million live with chronic infection and are at risk of developing cirrhosis or liver cancer; and 350,000 people die due to HCV related illnesses (WHO). Egypt has the highest prevalence of Hepatitis C in the world (Lavanchy, 2009). According to the WHO, the rate of chronic infection is 15% in Egypt, 4.8% in Pakistan, and 3.2% in China. The Egyptian Ministry of Health Program(MOHP) has two kinds of programs: one largely aimed at treatment of current chronic infections, and a second focused on prevention efforts to decrease HCV transmission(Yahia, 2011). However, a majority of the resources are allocated to treatment of HCV rather than prevention(Yahia, 2011). Yet, diagnosis and treatment lead to complete recovery in only 60% of cases and alone do not prevent transmission(Kamili, Drobeniuc, Araujo, & Hayden, 2012; Pawlotsky, 2004). Specific treatment for chronic HCV in Egypt requires at least a 36 week regimen of interferon and ribavirin and costs about US$ 3500, a price well above the Egyptian median income of US $ 2,070 per person per year (Yahia, 2011). Perhaps, diverting some of the funds towards prevention will offset the disease transmission, and the societal and economic burden of chronic HCV.

Focusing on prevention requires identification of major transmission risk factors and taking actions to curtail their impact. HCV transmission occurs through percutaneous exposure to infected blood (CDC). Given this fact that HCV can be transmitted through infected blood, it is reasonable to explore cultural practices that involve bloodletting, such as female genital mutilation, which is widespread in Egypt(El-Gibaly, Ibrahim, Mensch, & Clark, 2002). FGM is defined by the WHO as "all procedures that involve partial or total removal of the female genitalia, or other injury to the female genital organs for non-medical reasons" (WHO). Immediate complications of the FGM procedure include minor to severe bleeding depending on the amount of tissue excised(Momoh et al., 2001). FGM is a practice that is widespread in Egypt(El-Gibaly, Ibrahim, Mensch, & Clark, 2002). FGM is practiced in the African continent stretching from Senegal in the east, Egypt in the northeast and extends as far as Tanzania in the south (Kouba & Muasher, 1985). Of the 140 million girls and women who are currently living with FGM, 101 million reside in the African continent (WHO). The procedure is usually performed by medically unqualified people, who sometimes use unsterile instruments such as razor blades, knives, broken glass, sharp stones, or scalpels likely to be contaminated with disease agents (Momoh, Ladhani, Lochrie, & Rymer, 2001; Slack, 1988). Since FGM can be performed using unsterile instruments, and also involves bloodletting, we explored the association between FGM and HCV in Egypt.

1b. Purpose of the study

The goal of this study is to add to the evidence of risk factors for HCV seropositivity in Egypt, with a particular focus on FGM as a risk factor for hepatitis C. Using Demographic Health Survey data from Egypt (EDHS) in 2008, the prevalence rates of hepatitis C among women based on demographic, behavioral, and clinical variables were examined. The study goals are:

- To evaluate the association between HCV infection and FGM;
- To determine possible relationships between HCV infection and the type of provider who performs FGM (doctor, lay provider, etc.)
- To examine possible associations between social-demographic factors and HCV infection;
- To assess the relationship between HCV infection and knowledge and attitudes of women regarding FGM;
- To analyze clinical/iatrogenic risk factors such as, a history of blood transfusion, surgery, injection for schistosomiasis, etc., and their relationship with HCV.

CHAPTER II

REVIEW OF LITERATURE

2a. Virology and pathophysiology

The term hepatitis refers to inflammation of the liver which can be caused by infectious agents, such as viruses, or non-infectious agents, such as alcohol and drugs (http://www.cdc.gov/hepatitis/). The five most common types of viral hepatitis are caused by hepatitis A, B, C, D and E viruses, after which they are also named (http://www.cdc.gov/hepatitis/). The Hepatitis C virus (HCV) is a member of the genus Hepacivirus and the Flaviviridae family(Pawlotsky, 2004). The name HCV refers to any of six main groups (clades 1-6) or any of a number of subgroups of enveloped, single-stranded RNA viruses(Pawlotsky, 2004). Each Hepatitis C virus or HCV contains one polyprotein, which is processed in human liver cells or hepatocytes into structural (C, E1, E2 and p7) and nonstructural (NS1-3, NS4A-B and NS5A-B) subunits. In addition to this diversity in the types of HCV, HCV viruses are also highly mutative, with a mutation rate of 10^{-3} per nucleotide per generation(Chisari, 2005) (Chisari, 2005).

Initial HCV infection is often asymptomatic and self-resolving in 20% to 50% of cases by six months following infection(Pawlotsky, 2004). In most cases (50–80%), HCV infection becomes chronic(Pawlotsky, 2004). Although much of the mechanism of infection remains unknown, chronicity is impacted by weak CD41 and CD81 T-cell responses in human cells during the acute infection phase(Pawlotsky, 2004). This weak

response to the viral infection in some people could be due in part to the diversity of the virus, its high replication rate (10^{12}virions per day) and its ability to evolve new means of evading host cell defenses quickly after infection due to its high mutation rate (Chisari, 2005). Indeed, it is unknown whether the inability to clear the virus in the first six months in some people is due to antigen overload (resulting from all the factors previously listed), changes to the normal viral detection by the host cell caused by the virus, individual genetics or other factors(Chisari, 2005).

Even when chronic infection is established, HCV does not directly kill liver cells, except in the case of one specific clade called the HCV3(Pawlotsky, 2004). HCV3 directly induces lesions or accumulation of lipids in the hepatocytes referred to as steatosis(Pawlotsky, 2004). In most cases, steatosis is caused instead by locally driven immune responses, which are mainly non-specific and lead to inflammation(Chisari, 2005). Constant inflammation leads to death of liver cells and triggers fibrogenesis or the excessive buildup of collagen and other extracellular matrix constituents in the liver (Pawlotsky, 2004). Cirrhosis or scarring of the liver develops with increasing buildup and is facilitated by external factors, such as chronic alcohol consumption and viral co-infections, for example with HIV(Pawlotsky, 2004). Chronic infection with HCV causes cirrhosis in 10–20% of cases after 10–20 years of infection, and hepatocellular carcinoma or liver cancer in 1–4% of cases per year, in patients with HCV-related cirrhosis(Pawlotsky, 2004). Chronic HCV is also associated with other systemic conditions such as renal and skin diseases (Gumber & Chopra, 1995).

2b. Diagnosis and treatment

Around the world, approximately 170 million people are infected with the virus. When symptomatic, acute infection, or infection in the first six months of acquiring the virus, can be characterized by nausea, vomiting, abdominal pain, fatigue, pale colored stools and fever (Hoofnagle, 2003). However, only one-third of patients with acute infection have clinical manifestations (Gumber & Chopra, 1995). In addition to showing no clinical signs during the acute stage, about 50-80% of infected people go on to become chronic cases(Pawlotsky, 2004). According to the CDC, of those with chronic HCV, 60-70% of people show signs of liver disease, while many others who have chronic HCV infection do not have apparent clinical signs and are not aware of their infection, which allows them to serve as a major reservoir of the virus (http://www.cdc.gov/hepatitis/HCV/HCVfaq.htm#a14). The transmission of HCV occurs by contact with blood of an infected person(Pawlotsky, 2004). HCV is highly transmissible through repeated percutaneous exposure to infected blood, but any kind of parenteral transmission, such as occupational and perinatal exposure, can also lead to the transmission of HCV (http://www.cdc.gov/hepatitis/HCV/HCVfaq.htm#a14).

For infected people, conclusive diagnosis of HCV is somewhat problematic(Kamili et al., 2012). A review by Kamili, Drobeniuc, Araujo and Hayden (2012) describes the evolution of diagnosis of this virus. According to the review, in most laboratories, the first step of diagnosis involves detecting the presence of antibodies, or anti-HCV immunoglobulin G/IgG using assay, which is detectable after 8-9 weeks. However, the presence of anti-HCV alone cannot distinguish acute from chronic

infection, and cannot separate past infection that has already been cleared from current infection definitively(Kamili et al., 2012). Per Kamili and colleagues, the gold standard for the detection of current infection is the detection of HCV RNA through nucleic acid testing (NAT). Due to the requirements for this particular procedure, including expert technical staffs, expensive equipment and reagents, appropriate space and pristine serum or plasma samples, most laboratories do not actually use this procedure(Kamili et al., 2012).

If a person is successfully diagnosed with HCV, their treatment options are pretty limited. Currently, interferon and ribavirin for a period of thirty six weeks is used, and this is effective in clearing 60% of chronic HCV infections(Kamal et al., 2005). Vaccination against HCV is not yet available(Chisari, 2005), and prophylaxis with immunoglobulin is not effective after exposure already occurred(McGee, Cupell, Higgins, Renshaw, & Shaver, 2001). Since there is no vaccine and no post-exposure prophylaxis available, it is imperative to focus on methods to prevent the exposure from occurring (Alter, 1997; Control & Prevention, 1998) (http://www.cdc.gov).

2c. Women and HCV

In Egypt, several factors make women more susceptible to HCV than men, including women being more limited in their knowledge of the causes and transmission of this condition and the socio-economic disparities between the two genders. In Egypt's 2008 DHS health survey, men and women who were tested for HCV between ages 15-59 were asked specific questions pertaining to their knowledge and attitudes about hepatitis

C (El-Zanaty, Fatma, and Ann Way, 2009). Specifically, the survey questions included those who had heard about HCV, their understanding about the modes of transmission and prevention, and the sources from which they had received information. The test results indicate that in general, men (85%) were relatively more knowledgeable about hepatitis C than women (80%). Specifically, only 40% of female respondents were aware that HCV can be transmitted by coming in contact with the blood of an infected individual compared to 54% of males. Similar differences were found among men and women in questionnaires about transmission of HCV through unclean needles.

In addition to a gap in knowledge between men and women, there is significant evidence of a gender difference in the transmission of HCV. Wives were more likely to transmit the virus to their husbands than vice versa (Magder et al., 2005). A cross sectional serological survey was conducted to study the transmission of hepatitis C among spouses in two communities of Egypt (Magder et al., 2005). In that study, the probability of wife to husband transmission was 34% for HCV RNA positive wives and 10% for HCV RNA negative wives, due to the higher transmissibility of ongoing acute infection. Interestingly, the probability of husband to wife transmission was lesser; 3% for HCV RNA positive husbands to 0% for HCV RNA negative husbands. This study suggests that women are better able to transmit the virus than men, but the reason is unknown.

Similarly, the biological response of clearing the virus was significantly different for females compared to male. Females were more efficient in clearing the virus as

indicated by undetectable HCV RNA. (Bakr et al., 2006). The study showed that 44.6% of females cleared the virus compared to 33.7% of males, after adjusting for potential confounders. The above studies implicate that females are different than males in their biological response to HCV. While there is increased vulnerability due to social circumstances, there may be increased immunity biologically, though much more research is needed to confirm this. Isolating prevention factors pertaining to women opens up avenues for targeted public health approaches in preventing transmission of HCV infections among women.

2d. Risk Factors

a. Transmission. The mode of transmission varies greatly between industrialized and non-industrialized countries. In developed countries, intravenous drug abuse has been documented as the most common risk factor for HCV infections (Shepard, Finelli, & Alter, 2005). In the developing world, however, risk factors associated with increased risk of transmission of HCV are unsafe therapeutic injections and blood transfusion from unscreened blood donors (Shepard et al., 2005). A vast amount of literature shows evidence of transmission of hepatitis C through therapeutic procedures. The relatively recent discovery of HCV, much later than the advent of modern surgical and dental procedures enabled the virus to be a classic example of iatrogenic transmissions. As a result, clinicians are still seeing an increased rate of chronic hepatitis C among people who had received blood transfusions in the past (Prati, 2006). Egypt's high rate of chronic HCV infections is attributed to iatrogenic infections caused during mass campaigns against schistosomiasis (Frank et al., 2000). Mass campaigns, where a large

number of people were given tartar emetic intravenously using glass syringes for about 30 years up until the 1980's has resulted in an unprecedented rate of chronic HCV infections, the highest in the world. However, other developing nations such as India have also attributed chronic HCV to unsafe injection practices used to treat Kala-azar (Singh, Dwivedi, Sood, & Wali, 2000). Therefore, unsurprisingly, HCV is the most common cause of post-transfusion hepatitis.

b. Female Genital Mutilation [FGM]. The WHO has defined FGM as "all procedures involving partial or total removal of the external female genitalia or other injury to the female genital organs for non-medical reasons" (WHO).The WHO classification of FGM is as follows: Type I – partial or total removal of the clitoris and/or the prepuce (clitoridectomy); Type II – partial or total removal of the clitoris and the labia minora , with or without excision of the labia majora (excision); Type III – narrowing of the vaginal orifice with creation of a covering seal by cutting and appositioning the labia minora and/or the labia majora, with or without excision of the clitoris (infibulation); Type IV – all other harmful procedures to the female genitalia for non-medical purposes, for example, pricking, piercing, scraping, incising, and cauterization (Types of FGM).

The surgical practice of removing a part or all of the female external genitalia has been practiced for hundreds of years. In Egypt, for example, this practice has been around for more than a thousand years (Assaad, 1980). Dr. Meinardus, a sociologist, writes that this practice probably originated in Egypt during the time of Pharaohs. Despite the nature

of the practice itself, this practice has profound moral, societal and cultural significance. Contrary to modern belief, many mothers prefer it for their daughters in order to build a dignifying identity for them(Toubia, 1994). In an effort to find an explanation for the FGM practice in Egypt, Meinardus suggests that it is related to the Pharaonic belief in the bisexuality of gods;" just like the gods, every person has feminine and masculine souls, the feminine part of male soul resided in the prepuce and the masculine part of the female soul resided in the clitoris. Hence, in order for a man or woman to be fully grown up and be accepted into manhood and womanhood, they had to shed their feminine and masculine properties, respectively" (Meinardus, 1967). Many women endure this practice in order to gain respect and fulfillment in their societies and as a rite of passage into adulthood (Assaad, 1980).

Given the historical nature of FGM, it is often performed by traditional midwifes called Dayas or barbers using crude unsterile instruments, without anesthesia and with insufficient knowledge of female anatomy, providing many opportunities for transmission of infectious diseases (Diouf & Nour, 2012). A study using Demographic Health Survey from Kenya in 2003, showed that women who underwent FGM had higher odds of being HIV positive compared to their counterparts who did not go through FGM (Maslovskaya, Brown, & Padmadas, 2009). However, though HCV and HIV have similar transmission routes, some studies have shown no statistically significant association between FGM and HCV (Habib et al., 2003). On the other hand, male circumcision was found to have increased odds of association with HCV, which may be

explained by the fact that males are sometimes circumcised in small groups using the same instruments, unlike females in whom the procedure is generally performed individually(Habib et al., 2003). In this study, the age adjusted OR for females who were circumcised by an informal health provider for having HCV was 1.3 (0.5, 3.5), however, this was not statistically significant (Habib et al., 2003).

c. Age. A number of host factors affect the natural history of chronic HCV; among them age is one of the significant factors affecting the progression of disease (Seeff, 2006). In a study involving 2235 patients with HCV, the progression of fibrosis was closely associated with aging (Poynard, Bedossa, & Opolon, 1997). A cross-sectional survey in a rural community of the Nile Delta region revealed that anti-HCV prevalence increased sharply with age; in those <20 years old, anti-HCV prevalence was 9.3% compared to >50% prevalence in those older than 35 years (Abdel-Aziz et al., 2000). A multivariate regression analysis for independent risk factors of a community in the Nile Delta region in Egypt also showed that age was an independent risk factor for hepatitis C (Habib et al., 2003).

Age is not only associated with disease progression directly, but is also related with knowledge of HCV, with schistosomiasis treatment campaigns and with FGM. Age was significantly related to knowledge and attitudes about hepatitis C in the Egypt 2008 DHS data (EDHS)(El-Zanaty, 2009). According to the 2008 EDHS report, women between the age groups of 20-39 years were more likely to have known about hepatitis C than women younger or older. According to Arafa and colleagues (2005), the peak of

anti-HCV prevalence among older adults aged 40-54 years corresponds to the aging cohort of children who were infected through schistosomiasis campaigns in Egypt(Arafa et al., 2005). FGM is a ritual usually performed between the ages of 4 to 10 years, and in some communities it may be performed earlier (Toubia, 1994).

d. Education. The amount of education women have in general is related to their knowledge of HCV in particular. The number of women knowing about hepatitis C was much higher among women who had completed secondary or higher education (El-Zanaty, 2009). According to EDHS report 2008, 93.4% of women with "secondary education/higher" knew at least one of the ways in which the illness could be spread compared to only 54.2% of women who had "no education"(El-Zanaty, 2009). In a study involving a village with moderately high prevalence of hepatitis C in Upper Egypt, the risk of hepatitis C for those above 30 years old was higher among those who never attended college (Medhat et al., 2002).

e. Marital status. Some believe marriage is a surrogate marker for the sexual transmission of HCV; however, this view has been controversial, since several studies reported similar, rather than higher, prevalence of HCV among heterosexuals married couples and men who have sex with men (MSM) (ANNEMARIE WASLEY & Alter, 2000). MSM are usually considered a riskier sexual group and would be expected to have higher prevalence if the primary mode of infection was in fact sexual (Weasley& Alter, 2000). Whatever the reason, being married seems to be a risk factor for HCV. A community study of a rural village of Upper Egypt showed that the risk of seropositivity

significantly increased with marriage (Abdel-Aziz et al., 2000; Habib et al., 2003). In this study, the odds ratio of seropositivity with marriage was 4.1 (2.4-6.9) (Abdel-Aziz et al., 2000; Habib et al., 2003). Another assessment of the epidemiological pattern of transmission in a community of the Nile Delta region of Egypt reported that the odds ratio of marriage and increased risk of infection was 2.5, (1.0-6.1) (Arafa et al., 2005). A study in Taiwan also concluded that the risk of transmission increases with marriage and duration of marriage (Memon & Memon, 2002). The Taiwanese study found that infected couples were more likely to have shared toothbrushes and to have had more frequent sexual contacts.

f. Cesarean section. Physiologically, the placental barrier acts a shield to protect the baby from several pathogens, but this protective shield is compromised during miscarriage, abortion, labor, and child birth. Data from HCV positive pregnant women suggests that perinatal transmission of HCV occurs around the time of delivery (Mok, Pembrey, Tovo, & Newell, 2005). In one study of 441 mother-child pairs from the UK and Ireland followed through pregnancy and delivery, the findings concluded that a cesarean section before membrane rupture had a decreased risk of peripartum transmission than vaginal delivery (Gibb et al., 2000). However, whether or not cesarean section is a risk factor in the transmission of HCV in Egypt remains a controversy. A study of risk factors in rural areas of Egypt concluded that instrumental delivery (cesarean sections, episiotomy, ventouse) was associated with a 3.49 (1.12-10.9) fold increased risk of HCV transmission (Arafa et al., 2005). Another study of risk factors in

the Nile Delta region concluded that mothers who had cesarean sections or abortion had a OR of 1.4 (1.0, 1.9) for transmission of HCV (Habib et al., 2003).

g. Type of residence. The place of residence is an indirect measure for several health indices, such as, access to healthcare services, education, socio-economic conditions, and various cultural practices that may be associated with decreased or increased risk of infections (Eberhardt & Pamuk, 2004). Several factors play a role in the pathogenesis of HCV in relation to the residence. One such factor is the relationship between place of residence and prevalence of schistosomiasis. The more rural Lower Egypt has always had a higher rate of schistosomiasis than Upper Egypt; whereas, the rates in Upper and Middle Egypt increased only as a result of conversion from basin to perennial irrigation which accelerated the transmission of schistosomiasis. The city dwellers of Upper Egypt and the areas surrounding Alexandria have lower rates of schistosomiasis potentially explaining why rural areas have higher prevalence of HCV than urban areas of Egypt(Frank et al., 2000). Currently, HCV prevalence correlates closely to schistosomiasis prevalence in all parts of Egypt, and many blame Iatrogenic transmission (Frank et al., 2000).

h. Type of FGM provider. In Egypt, FGM has been traditionally performed by traditional midwives known as Daya, gypsies known as Ghagharia, and also by a barber. A study conducted in Egypt showed that the age adjusted risk for females circumcised by an informal healthcare provider such as a barber or traditional birth attendants(TBA) is 1.6 (0.7 – 3.8) (Medhat et al., 2002). However, this significance was lost in multivariate

analysis. These results are consistent with another study of a community in the Nile Delta region in which the risk of HCV for those who underwent FGM by an informal health provider was 1.3 (0.5 – 3.5) (Habib et al., 2003). Similar to these 2 studies, another study of pregnant women in Egypt found that there is a 1.43 (1.03 – 1.98) times increased risk of hepatitis C, when circumcision was done by a TBA or barber (Stoszek et al., 2006). The government allowed the practice to be performed by medical practitioners for a period of time during the mid-nineties but banned FGM after the death of a 11 year old, who bled to death after being circumcised by a barber (Wiens, 1996). The brief institutionalization of FMG led to medicalization of this practice. Thereafter, medicalization has been fiercely debated by some as a harm-reduction practice that improves safety of FGM and thereby health of women (Shell-Duncan, 2001). Other studies have reported medicalization as one of the factors fueling the growth of the practice (Ugboma, Akani, & Babatunde, 2004).

i. Religious and cultural beliefs. There is limited evidence of religious precepts to the practice of FGM, although, often ignorantly, it is cited as a reason (Assaad, 1980). The practice is rooted in the belief that FGM moderates sexuality in women, that it enhances the marriageability for girls, prevents adultery, and helps maintain virginity(El-Gibaly et al., 2002; Toubia, 1994). Since religious precepts strongly support these moral values, FGM is commonly used in conjunction with religion(Slack, 1988). FGM was in practice before the advent of Abrahamic religions; since people had earnest beliefs about this cultural practice, overtime, it has become embedded in the African tradition and

religion (Slack, 1988). Although, the Islamic religion is often cited for strengthening the practice; it is to be noted that FGM is not practiced in a great majority of Muslim countries (Wiens, 1996). Furthermore, FGM is a practice that is embedded in many religious cultures in Africa (Slack, 1988).

j. Lifetime History of Medical Procedure and Injections. Since its discovery in 1989, many developed countries implemented screening for HCV in the early 90's(Hibbs et al., 1993). However, many developing countries did not practice screening of donor blood for HCV until recently. Early nineties signaled the presence of transfusion associated hepatitis to be very high among Egyptian blood donors(Saeed et al., 1991). In contrast to the United States, where volunteer blood donors had about 1-4% anti-HCV, unpaid blood donors of Egypt were found to have anti-HCV prevalence rates of about 11-22% (Abdel-Wahab et al., 1994). A study comparing the prevalence of HCV among transfused and non-transfused children in Egypt reported the prevalence of anti-HCV to be 55% in the study population, and among these children 92% had history of multiple blood transfusions for hematologic disorders(Khalifa, Mitchell, Watts, El-Samahy, & El-Sayed, 1993).

Injection drug use has been established as a common mode of transmission of HCV, and a large proportion of respondents of EDHS had received injections(El-Zanaty, 2009). About 8 percent reported that they received injection for schistosomiasis and 93 percent reported that they have received injection for some other purpose. Of the respondents, 4 out of 10 reported that the syringe or needle used for at least one of the

injection that they received was reused (El-Zanaty, 2009). Despite varying purposes for receiving and sharing injections, the risk of transmission of HCV in a country with a large reservoir of chronic infection is universally high (Hagan et al., 2001; Thorpe et al., 2002). In a study of risk factors for seropositivity, dental treatment was associated with a slightly increased, though statistically insignificant risk of HCV (Abdel-Aziz et al., 2000). However, studies from other countries have reported extensive contamination of dental equipment after treatment of patients with hepatitis C (Piazza et al., 1995).

2d. Summary

Receiving treatment for Schistosomiasis has been a well-established risk factor in the transmission of HCV in Egypt and played a significant role in the current epidemiology of chronic HCV infections. Furthermore, older age group is a significant risk factor for HCV; this corresponds to the cohort of the ageing population who received Schistosomiasis treatment between 1960 and 1980. There was a clear association between marital status and HCV, with the risk of HCV increasing with the duration of marriage, which supports the hypothesis that HCV can be sexually transmitted. The role of FGM in the epidemiology of HCV has not been well established, and there is a limited literature suggesting an association between these two variables. However, there is some evidence to support the transmission of HCV when it is performed by an untrained, nonmedical professional. Lifetime history of blood transfusions has been a well-established risk factor in Egypt. Although studies from other countries have shown evidence of

associations between HCV and dental treatment, surgeries and injection sharing, there is limited evidence to support this hypothesis among the Egyptian population.

The literature review examined the risk factors associated with the transmission of HCV infection. Emphasis was given to studies focusing on associations between HCV and FGM. However, a comprehensive review of general risk factors associated with the transmission of HCV has been included. Aligning with the overarching goal of this thesis, a general analysis of health consequences related to FGM has also been included. The literature review was used as guidance for the variables used in the analysis.

2e. Theoretical Basis of the Study

The burden of HCV in human physiology and economy arises from its effect to produce chronic disease; hence, this study evaluates the risk factors of HCV the Life Course Perspective as a theoretical model for chronic disease (Ben-Shlomo & Kuh, 2002; Hall, Yee, & Thomas, 2002). This theory acknowledges the presence of biological, behavioral, and psychosocial pathways that operate across all stages of an individual's lifespan to cause and modify disease. This theory postulates that there is a cumulative burden of risk due to psychosocial and cultural determinants that influence an individual's chances of acquiring disease. Therefore, women from certain psychosocial backgrounds have an increased risk of acquiring HCV and suffer from chronic sequel due to infection.

CHAPTER III

METHODOLOGY

3a. Data Sources and Study Population

The source of data for the study came from the Demographic and Health Survey of Egypt for 2008, otherwise known as EDHS 2008. The 2008 EDHS is the ninth in this series of surveys conducted in Egypt. According to EDHS 2008 report, the goal of the 2008 EDHS is to provide estimation of key health indicators; such as fertility, use of contraceptives, infant and child mortality, immunization levels, maternal and child health, and nutrition. In order to achieve this goal, nationally representative sample of 16,527 "ever-married" women between the ages of 15-49 were interviewed. Additionally, the 2008 EDHS also collected information of specific health issues that were relevant to the population of Egypt. One in four households from the sample was chosen for the health issues survey; 6,578 women and 5,430 men between the ages of 15-59 were interviewed. The key topics covered in the health issues subsample were knowledge and awareness of HIV/AIDS and hepatitis C, avian influenza, history of hypertension, cardiovascular illness, diabetes and liver disease. The survey also covered knowledge and attitude related to female circumcision, healthcare costs and health insurance coverage and collected specimens from the subsample to be tested for HIV and Hepatitis C (Fatma El-Zanaty, 2008).

DHS is a survey funded by USAID in less developed countries. DHS uses a standardized model of questionnaire across all countries that are included. Each question

has a particular code to maintain standardization across all countries. Surveys are typically conducted once every four years, and a report of key population indicators is published after each survey. Results of the research survey are then disseminated through seminars, web-based tools and other technologies and can then be further used for program design and evaluation. DHS caters these tools to a wide range of audiences including researchers. For the purpose of this study, the individual, household and biomarker data files from EDHS 2008 were used. All women who were interviewed for the health issues subsample and underwent lab testing for Hepatitis C were included in the analysis.

Unlike the other two data files used for the study, the biomarker data file did not have a "CASEID" number. Hence, an identification number was created by concatenating the cluster number, household number and line number. The files were then merged using the key variables.

3b. Study measures

a. **Dependent variable.** HCV status was used as the main dependent variable throughout the analysis. HCV status was determined based on the results of the biomarker data file; women who tested positive for the HCV antigen were further tested for the presence of HCV RNA. Women who had a positive test result in either one of these tests were coded as being positive for HCV. This variable was computed from the variable named "OB03A" and "OB03B" from the biomarker data file and was originally labeled as *Blood test result: Antigen for HCV, and Blood test result: HCV RNA,*

respectively. HCV status was used as the main dependent variable throughout the analysis. All women between the ages of 15-59 who underwent Hepatitis C testing were included in the analysis, unless their test results showed to be "indeterminate", making it unclear whether such women were positive or negative for HCV infection. The prevalence of Hepatitis C among women was determined through the study.

b. Independent variables. The variables that were included in the study were obtained from the individual file. These measures were categorized as social-demographic variables, behavioral variables relating to FGM, and clinical/iatrogenic variables that have potential associations for HCV infection. Social demographic variables included age, education, marital status, and type of residence; behavioral variables included whether or not the woman had FGM, and questions relating to knowledge and beliefs associated with FGM; clinical variables included history of blood transfusion, surgery, history of sharing syringes or injections, history of receiving injections for schistosomiasis.

Social - Demographic Measures

Age. Age was obtained from the variable labeled *age of respondent calculated*. This measure had been calculated using the date of birth of the subjects who were surveyed in EDHS 2008. Age was a measure in whole number; this measure was then recoded into a categorical variable of five categories as follows; age 15-19, age 20-29, age 30-39, age 40-49, and age 50-59.

Education. Education was categorized into the following groups; no education, some primary, primary complete/some secondary and secondary complete/higher.

Marital status. Marital status was categorized as follows: married, widowed, divorced, separated, signed contract, and never married. All those who were married, widowed, divorced, or separated were re-coded as "*ever-married*" and those who had signed contract for marriage and never married were re-coded as "*never married*".

Residence. Residence was categorized as urban or rural.

Measures Relating to Attitude and Behavior

History of FGM. The survey questionnaire stated "*have you yourself been circumcised"?* The responses were either yes or no and were coded 1 and 2, respectively. Those who answered "no" were used as a reference value in analysis. Those who answered don't know were coded as a discrete missing value.

FGM performer. Information about the person who performed the FGM was obtained from question I204 of the individual file. The responses were coded as follows: 1 for doctor, 2 for a nurse/health practitioner, 3 for daya, 4 for barber, and 5 for ghagaria. Those who answered "don't know" were coded as a discrete missing value.

Religious beliefs associated with FGM. This measure was obtained from question #I209 of the individual file. The responses were either "yes", "no", or "don't know"; and were coded 1, 2 and 8, respectively. Those coded as 8 were recoded as a discrete missing value.

Belief that FGM can continue. The original code for this question was # I210 from the individual file of EDHS 2008. An affirmative response was coded as 1 and a negative response was coded as 2. All the women who answered "don't know" were coded as a discrete missing value.

Measures associated with potential clinical/iatrogenic risk factors for HCV

History of Blood transfusion. The question was originally labeled *have you ever had a blood transfusion*. A positive response was coded as 1 and a negative response was coded as 2. [# I501B] This response and coding was the same for all clinical measures stated below.

History of Surgery. A history of any surgery in the past was stated in the questionnaire as, "*Ever had any surgery in the past*"? [# I501A].

History of sharing needles or syringes. EDHS questionnaire # I504 was used to identify this variable; the questionnaire stated, "Was the same needle or syringe used by somebody"?

History of injection for schistosomiasis. This question was stated as follows: "*ever received any injection for schistosomiasis"?* [# I502A].

3c. Statistical Analysis

The statistical package for Social Sciences [SPSS] version 21 was used to truncate, organize and analyze the data from EDHS 2008 to make it suitable for the study. Frequency tables to determine the distribution of HCV status across these variables

were cross tabulated with same. The estimation of HCV infection between different categories of study measures were compared using the Pearson Chi-square test, and univariate and multivariate logistic regression analyses were performed to estimate the factors associated with HCV positivity. HCV status was used as the dependent variable in all models [Coded as 1 for positive and 0 for a negative result]. The following independent variables were categorized: age, education, marital status, residence, history of FGM, FGM performer, religious belief for FGM, belief that FGM can continue, history of blood transfusion, history of surgery, history of sharing needles or syringe, history of injection for schistosomiasis. A P-value of <0.05 and a confidence interval of 95% were used to determine statistical significance throughout the analysis.

Chapter IV

Results

4a. Sample Demographics

The total number of EDHS respondents who met the study eligibility criteria was 6569 out of which 711 were found to be HCV positive. The demographic profile of participants with respect to independent variables is presented below in table 1. About 32% of respondents were between the ages of 20-29, making this the largest category among all age groups. Around 40% of the respondents had completed secondary or higher education, 74% were married and 58% resided in a rural area. An overwhelming 90.9% of respondents had a history of FGM; 52% believed in religious precepts for FGM; and 56% believe that the practice can continue. Only 4.2% of respondents had a history of blood transfusion, while 45.9% had a history of surgery. Similarly only3.8% had a history of sharing needles or syringes, and only 5.1% had received injection for schistosomiasis.

Table 1: Sample Size and percentage of women included in the study from EDHS 2008

Variables	N	%
Age		
15-19	1106	16.8
20-29	2110	32.1
30-39	1447	22.0
40-49	1161	17.6
50-59	754	11.5
Education		
No education	2048	31.1
Some primary	536	8.1
Primary complete/some secondary	1378	20.9
Secondary complete/higher	2616	39.8
Marital Status		
Ever married	4914	74.8
Never married	1655	25.2
Residence		
Urban	2745	41.8
Rural	3824	58.2
History of FGM		
Yes	5962	90.9
No	600	9.1
Religious belief for FGM		
Yes	3434	52.3
No	1895	28.8
Belief that FGM can continue		
Yes	3683	56.1
No	2156	32.8
History of blood transfusion		
Yes	276	4.2
No	6276	95.5
History of surgery		
Yes	3012	45.9

No	3547	54
History of sharing needle or syringe		
Yes	252	3.8
No	5679	86.5
History of injection for Schistosomiasis		
Yes	332	5.1
No	6136	93.4

4b. Distribution of variables across HCV status

The distribution characteristics of eligible participants across HCV status is shown in Table 2. There were statistically significant differences between subjects who were HCV positive and those who were HCV negative with respect to age, education, marital status and residence($P < 0.05$). As shown, the age group of 40-49 represented the cohort with the largest HCV positive people compared to other age categories that were investigated. The highest proportion of HCV positive people were in the no education group (54.6%), followed by the secondary complete/higher category (22.2%), primary complete/secondary category (12.1%) and some primary (11.1%). The ever married group and rural residents had higher proportions of HCV positives than their respective counterparts. The groups with affirmative responses to history of FGM, religious precept to FGM, belief that FGM can continue, blood transfusion, surgery, sharing needles and injection for schistosomiasis all had higher proportions of HCV positives than their respective counterparts. There was a statistically significant difference between the HCV positive and negative groups across all variables.

Table 2: Distribution characteristics of participants by HCV status; the P-value signifies difference between HCV positive and negative groups

Variable	HCV positive %	HCV negative%	P - value
Age category			<0.05
15-19	3.9	18.4	
20-29	14.2	34.3	
30-39	21.1	22.1	
40-49	32.5	15.8	
50-59	28.3	9.4	
Education			<0.05
No education	54.6	28.3	
Some primary	11.1	7.8	
Primary complete/some secondary	12.1	22.0	
Secondary complete/higher	22.2	41.9	
Marital Status			<0.05
Ever married	91.8	72.7	
Never married	8.2	27.3	
Residence			<0.05
Urban	26.0	43.7	
Rural	74.0	56.3	
History of FGM			<0.05
Yes	97.7	90.0	
No	2.3	10.0	
Religious belief for FGM			<0.05
Yes	77.8	62.8	
No	22.2	37.2	
Belief that FGM can continue			<0.05
Yes	79.4	61.1	
No	20.6	38.9	
History of blood transfusion			<0.05
Yes	6.9	3.9	
No	93.1	96.1	
History of surgery			<0.05
Yes	52.5	45.1	
No	47.5	54.9	
History of sharing needles or			<0.05

syringe			
Yes	6.0	4.0	
No	94.0	96.0	
History of injection for schistosomiasis			<0.05
Yes	10.9	4.4	
No	89.1	95.6	

4c. Association between FGM and other independent variables with HCV status

Results of the univariate analysis of the association between independent variables and HCV are shown in Table 3. In the univariate model, subjects who have had FGM had 4.82 (2.91 – 7.96) increased odds of HCV compared to those who did not have FGM. A linear increase in odds of HCV with increasing age was apparent and ranged from 1.94 to 14.10 in subjects in the 20-29 to 50-59 age categories, respectively. The results of univariate analysis also showed that lack of education and primary education were associated with increased odds of HCV compared to subjects who have completed secondary education, OR of 3.64 (3.00, 4.43) and 2.69 (2.02, 3.59), respectively. Ever been married and rural residency was each associated with increased odds of HCV, OR of 4.22 (3.21-5.55) and 2.21 (1.85-2.63), respectively. A religious belief for FGM and a positive response for FGM can continue are also associated with 2.08 (1.69 – 2.55) and 2.45 (2.01 – 3.00), respectively, increased odds of HCV infection. Iatrogenic factors such as a positive history of blood transfusion, surgery, sharing needles, and a history of schistosomiasis is associated with 1.84 (1.34 – 2.53), 1.35 (1.15 – 1.57), 1.51 (1.07 – 2.15), and 2.63 (2.01 – 3.45), respectively, increased odds of HCV infection.

Table 3: Association of FGM and HCV status; the OR (95% CI) represents the odds ratio after univariate analysis

Variable	OR (95% CI)	P-value
History of FGM		
Yes	4.82 (2.91 – 7.96)	<0.05
No	Reference	
Age category		
15-19	Reference	
20-29	1.94 (1.27-2.96)	<0.05
30-39	4.46 (2.95 -6.72)	<0.05
40-49	9.58 (6.41-14.32)	<0.05
50-59	14.10 (9.37-21.21)	<0.05
Education		
No education	3.64 (3.00 - 4.43)	<0.05
Some primary	2.69 (2.02 - 3.59)	<0.05
Primary complete/some secondary	1.04 (0.79 - 1.36)	>0.05
Secondary complete/higher	Reference	
Marital Status		
Ever married	4.22 (3.21 – 5.55)	<0.05
Never married	Reference	
Residence		
Rural	2.21 (1.85 - 2.63)	<0.05
Urban	Reference	
Religious belief for FGM		
Yes	2.08 (1.69 – 2.55)	<0.05
No	Reference	
Belief that FGM can continue		
Yes	2.45 (2.01 – 3.00)	<0.05
No	Reference	
History of blood transfusion		
Yes	1.84 (1.34 - 2.53)	<0.05
No	Reference	
History of surgery		
Yes	1.35 (1.15 – 1.57)	<0.05
No	Reference	
History of sharing needles or		

syringe		
Yes	1.51 (1.07-2.15)	<0.05
No	Reference	
History of injection for schistosomiasis		
Yes	2.63 (2.01 - 3.45)	<0.05
No	Reference	

4d. Association of FGM and HCV status in multivariate analysis

Based on the univariate analysis and literature review, age and schistosomiasis injection were controlled for in the multivariate analysis shown in table 4 below. Adjusting for age and schistosmiasis injection, the odds of association between FGM and HCV infection decreased from 4.82 to 2.98 (1.76 – 5.05). Other independent variables that had a statistically significant association with HCV status were education, residence, and beliefs. Adjusting for age and schistosomiasis injections, participants who lacked education had increased odds of association with HCV infection compared to those who completed secondary education with an OR of 2.08(1.68 – 2.57). Living in a rural residence also had a statistically significant association with HCV infection with OR of 2.60 (2.16 – 3.14), compared to urban residents. After adjusting for age and schistosomiasis injection, religious beliefs and an affirmative response to FGM can continue each had increased odds of association with HCV infection with OR of 1.53 (1.23 – 1.89), and 1.69 (1.37 – 2.10), respectively.

Table 4: Association of FGM and HCV infection after adjustment for age and schistosomiasis injection

Variable	OR (95% CI)	P-value
History of FGM		
Yes	2.98 (1.76 – 5.05)	<0.05
No	Reference	
Education		
No education	2.08 (1.68 – 2.57)	<0.05
Some primary	1.57 (1.15 – 2.14)	<0.05
Primary complete/some secondary	1.22 (0.91 - 1.62)	>0.05
Secondary complete/higher	Reference	
Marital Status		
Ever married	1.39 (0.98 – 1.98)	>0.05
Never married	Reference	
Residence		
Rural	2.60 (2.16 – 3.14)	<0.05
Urban	Reference	
Religious belief for FGM		
Yes	1.53 (1.23 – 1.89)	<0.05
No	Reference	
Belief that FGM can continue		
Yes	1.69 (1.37 – 2.10)	<0.05
No	Reference	
History of blood transfusion		
Yes	1.35 (0.96 – 1.91)	>0.05
No	Reference	
History of surgery		
Yes	1.05 (0.89 – 1.25)	>0.05
No	Reference	
History of sharing needles or syringe		
Yes	1.33 (0.91 - 1.95)	>0.05
No	Reference	

Table 5: Association between various categories FGM performer and HCV infection in the univariate model

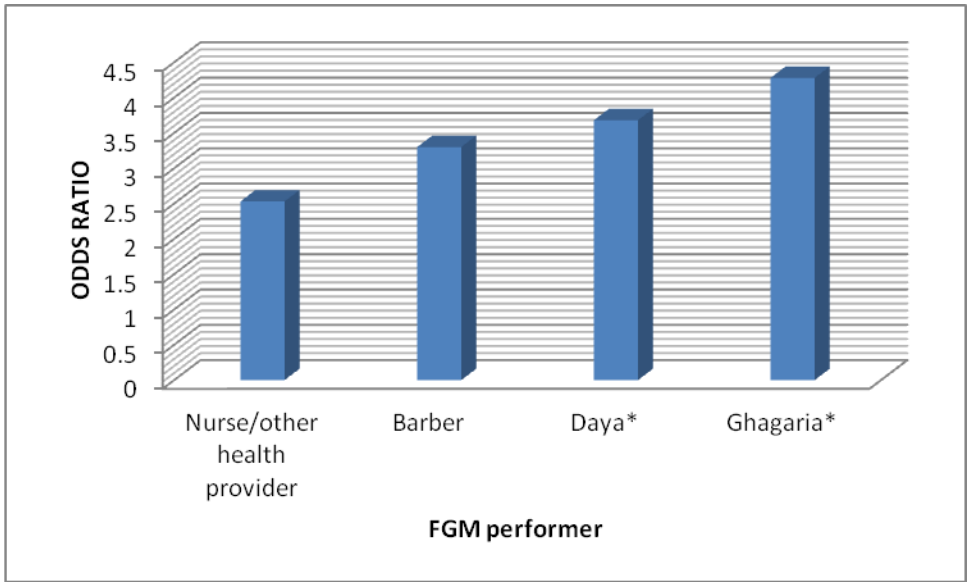
Variable	OR (95% CI)	P - value
FGM performer		
Doctor	Reference	
Nurse/other health provider	2.53 (1.65 – 3.89)	<0.05
Daya*	3.68 (2.76 – 4.90)	<0.05
Barber	3.30 (1.85 – 5.88)	<0.05
Ghagaria*	4.28 (2.31 – 7.91)	<0.05

**Daya – traditional midwife; * Ghagaria – Gypsy*

4e. Association of FGM performer and HCV infection

Table 5 shows comparison of odds of HCV across performer of FGM using Doctors as reference (Figure1). As shown, subject who received FGM from non-physicians had a much increased odds of HCV. Compared to doctors, subjects who received FGM from nurses, Daya, Barbers and Ghagaria had 2.53(1.65 – 3.89), 3.68(2.76 – 4.90), 3.30(1.85 – 5.88) and 4.28(2.31 – 7.91) increased odds of HCV, respectively.

Figure 1: Association of various FGM performer and HCV infection



**Daya – traditional midwife; * Ghagaria - Gypsy*

Table 6 shows the association for FGM performer and HCV infection in the multivariate analysis. As shown, after adjusting for age and injection for schistosomiasis, subjects who received FGM from nurses and daya had increased odds of 1.75 (1.12 – 2.74), and 1.66 (1.22 – 2.27), respectively.

Table 6: Association of FGM performer and HCV infection after adjusting for age and injection for schistosomiasis

Variable	OR (95% CI)	P - value
FGM performer		
Doctor	Reference	
Nurse/other health provider	1.75 (1.12 – 2.74)	<0.05
Daya*	1.66 (1.22 – 2.27)	<0.05
Barber	1.51 (0.82 – 2.76)	>0.05
Ghagaria*	1.33 (0.69 – 2.58)	>0.05

**Daya – traditional midwife; * Ghagaria - Gypsy*

Chapter V

Discussion and Conclusion

5a. Discussion

Studying factors associated with HCV infection play an important role in facilitating programs that target prevention. HCV in Egypt has been quoted as a socioeconomic disease that is attributable to social practices that can be prevented through infection control in the healthcare industry (Yahia, 2011). Further, treatment of chronic HCV in Egypt has a cost higher than the median income rate of Egypt(Yahia, 2011). Hence; there is an urgent need for prevention to reduce the societal, economic and health burden of the disease. There are a few studies that have studied associations of female circumcision and Hepatitis C; however, not many have utilized a nationally representative population of Egypt. This is particularly important since prevention of hepatitis will not only reduce the burden of disease in women, but may also have an impact in reducing the risk of transmission in their sexual partners and offspring. There is also a limitation in the literature, associating FGM with HCV; therefore, this study is significant in implicating this traditional practice, which may play a role in decreasing the incidence of HCV, particularly in women.

Association between HCV infection and FGM

The study objective was to find the association between FGM and chronic HCV in Egypt using EDHS 2008. The study utilized self-reported female circumcision and laboratory measures to detect the prevalence of HCV. The main question of the study was

whether prevalence of HCV was different in women who had FGM compared to women who did not have FGM. The unadjusted OR of HCV for women who had FGM was 4.82 (2.91 – 7.96); and after adjustment for age and schistosomiasis injection, the OR was 2.98 (1.76 – 5.05). The OR obtained in this study is higher than the estimates obtained from other studies. In a study by Habib et al, the age adjusted OR for females who were circumcised by an informal health provider was 1.3 (0.5, 3.5), however, this was not statistically significant(Habib et al., 2003). Although Schistosomiasis has been a well-established factor for the current prevalence rates of HCV, our study consistently also showed an association of FGM with HCV infections (Frank et al., 2000). This finding is in contrast to the study by Medhat et al, which concluded that circumcision per se was not associated with HCV(Medhat et al., 2002). The question we attempted to answer is whether there was an association between FGM and HCV even after controlling for all known confounders from the literature and univariate analysis. This is significant because it shows that there is a direct relationship between FGM and HCV infections. However, it should be noted that we did not look at the effect of transmission of HCV through other possible routes such as C-sections and episiotomy during childbirth.

Relationship between HCV infection and the type of provider who performs FGM

The variable "*FGM performer"* was used in univariate logistic regression analysis with the objective of answering whether there was a difference in association between HCV status, when it was performed by traditional midwives called daya, gypsies who are called ghagaria, and barbers. Among all categories of people performing the

circumcision, FGM performed by a nurse/other health provider had the lowest OR of 2.53 (1.65 – 3.89). Among all unskilled professionals, FGM performed by ghagaria had the highest OR for HCV of 4.28 (2.31 – 7.91). Circumcision performed by barber and daya had a POR of 3.30 (1.85 – 5.88), and 3.68 (2.76 – 4.90), respectively. These ORs are all higher than ones reported by Medhat et al. (2002) which found that the age adjusted OR for HCV and female circumcision when performed by informal providers was 0.4 (0.2 – 1.2) and by Stoszek et al (2006), were it was concluded that being circumcised by a barber or traditional birth attendant was associated with HCV with an OR of 1.53 (0.94 – 2.57). The OR reported by Habib et al. (2003) for circumcisions by an informal health provide,OR of 1.7 (1.00 - 3.00), was the closest to the current study results found in the literature, but the former finding was only applicable to boys over 20.Although many of the findings from the literature have not shown statistical significance, the findings from this study suggest increased odds for HCV when the circumcision is performed by a daya, ghagaria, or barber. Adjusting for *age* and *schistosomiasis injection,* the association of HCV when FGM performer was a nurse or a daya remained statistically significant. The adjusted OR was 1.75 (1.12 – 2.74) and 1.66 (1.22 – 2.27), respectively. In light of these results, it is arguable whether or not "medicalization" or legally allowing female circumcision to be performed by medical professionals may decrease the incidence of disease (Shell-Duncan, 2001). The secondary goal of this study was to assess the relationship between FGM and HCV and we found that there is in fact a relationship between the provider and HCV. Medical professionals have the lowest odds of association with HCV. An additional benefit of using medical

provider is the opportunity of educating women of the risks associated with the practice of FGM. This is significant because of ongoing argument of medicalization; however, despite reduced risk of HCV when FGM is performed by medical profession, the risk of contracting HCV from FGM is still present. FGM is a risk, and if a ban was possible might be the best course of action, and in its absence, allowing the medical profession to conduct FGM reduces the transmission of HCV infections. The potential side effect of medicalization is institutionalization of the practice of FGM; however, there is an opportunity for providing counseling for women through the medical profession in addition to reduction of HCV transmission.

Associations between social-demographic factors and HCV infection

Age consistently emerged as a variable that was strongly associated with HCV in women. There was a linear increase in odds of association with HCV across the age categories 30-39, 40-49, 50-59 with OR of 4.46 (2.95 – 6.72), 9.58 (6.41 -14.32) and 14.10 (9.37 -21.21), respectively. This is consistent with the finding that those who may have received schistosomiasis injections as children currently belong to this aging cohort of adults(Arafa et al., 2005). Even after adjustment for age and schistosomiasis injection, education was a variable of statistical significance. Subjects who had no education and those with some primary education had increased odds of association for HCV infection compared to women who had completed secondary education or higher, with an OR of 2.08 (1.68 – 2.57) and 1.57 (1.15 – 2.14), respectively. Although the association between education and HCV has not been particularly studied, there have been studies associating

health, in general, with education(Lleras-Muney, 2005; Lynch, 2003), which suggests that education plays an important role in accessing healthcare, cost of living, socio-economic status and so forth. Our study results could be explained by this theory that education may play a role in any disease outcome. The association between marital status and HCV infection did not show statistical significance in either the univariate or multivariate models in our study. This is inconsistent with the finding by previous studies which showed a significant association between marriage and HCV (Abdel-Aziz et al., 2000; Arafa et al., 2005; Habib et al., 2003). The finding that rural residence had increased odds of association with HCV is consistent with the study by Frank et al; in our study, subjects residing in rural areas had an OR of 2.60 (2.16 – 3.14) after adjusting for age and schistosmiasis injection(Frank et al., 2000).

Relationship between HCV infection and knowledge and attitudes of women regarding FGM

This measure is one of the unique natures of this study due to a limitation in the literature with regards to people's beliefs regarding circumcision and how this affects the transmission of HCV. The most common reasons for FGM were religious beliefs and to follow the ancestral culture (Assaad, 1980). Adjusting for age and schistosomiasis, the OR for the association between HCV and religious belief is 1.53 (1.23 – 1.89), and the OR for HCV and an affirmative response for FGM can continue is 1.69 (1.37 – 2.10). This result is supported by a study done by Sayed et al. (1996) which found that 92% of mothers who allowed their daughters to be circumcised were illiterate and additionally the most prevalent reason for the practice was because it followed customs and beliefs

(Sayed, El-Aty, & Fadel, 1996). Therefore, this finding raises concerns about whether abolition of the practice is feasible in the near future and whether medicalization can provide a solution to decrease the incidence of HCV infection (Shell-Duncan, 2001). Prevention programs should take into the consideration the fact that most people wish to continue the practice, and therefore should not focus on eradication or banning of the practice per se. For instance, a law banning this practice may not be effective in curtailing the practice but could instead lead people to obtain services from less sanitary knowledgeable providers such barbers and gypsies. Perhaps to facilitate the reduction of HCV transmission associated with FGM, religious leaders and medical professionals could serve as counselors to local people. Religious leaders are key stakeholders since many people have religious precepts for FGM.

Analysis of clinical/iatrogenic risk factors such as a history of blood transfusion, surgery, injection for schistosomiasis, and injection sharing, and the relationship with HCV infection

Consistent with the literature from the early nineties, the results from our study showed a statistically significant relationship of blood transfusion with HCV, with an OR of 1.84 (1.34 – 2.53) (Abdel-Wahab et al., 1994; Hibbs et al., 1993). However, after adjusting for age and schistosomiasis injection, this relationship between blood transfusion and HCV infection was no longer statistically significant. An analysis of the relationship between surgery and HCV infection, revealed an association between history of surgery and HCV, OR of 1.35 (1.15 – 1.57). Although intravenous drug use (IVDU) is uncommon in Egypt, sharing medical equipment and syringes are culturally acceptable and may have contributed to HCV (Medhat et al., 2002; Yahia, 2011). Our study results

revealed an increased odds of association between history of injection sharing and HCV infection, with an unadjusted OR of 1.51 (1.07- 2.15). Regardless of the purpose of receiving injections; those who had shared the syringe or needle had a higher risk for HCV. Among all clinical variables, having had an injection for schistosomiasis remained statistically significant in multivariate analysis. This finding is consistent with the vast amount of literature supporting the relationship(Frank et al., 2000; Strickland, 2006). Most notably, in addition to history of injection for schistosomiasis, having had FGM remained statistically significant in multivariate analysis, even after adjusting for age and schistosomiasis.

5b. Limitations

There are some limitations to the study. Although DHS uses a standardized questionnaire and is designed to be a robust survey across countries, there are opportunities for self-report bias with any secondary data. Secondly, a vast majority of women included in this study had FGM, which may have strengthened the magnitude of the relationship between FGM and HCV infections.

5c. Recommendations

Future studies' analyzing the relationship between FGM and HCV among women is warranted. Specifically, new studies need to employ recent data from EDHS 2012. A more robust model would be to compare equal proportions of women who had FGM with those who did not have FGM. Studies can also employ subjects from other countries to compare similar relationships. Additionally, future studies need to consider preconceived notions and beliefs and employ methods to quantify the association with HCV infections.

Our study results reveal that many of the women would prefer for this practice to be continued and that it is required by religious precepts. Among study subjects, more than 50% of women provided affirmative answers to religious precepts and FGM can continue. In light of these results; it is necessary to consider that women may obtain FGM through lay providers such as traditional midwives, barbers, and gypsies and put themselves at risk for HCV infection.

5d. Strengths of the study

Despite limitations, this study has some notable strength. DHS employs a nationally representative sample, and therefore the results of the study can be applicable to the Egyptian women. Our study also included several variables that have not been analyzed by previous studies; such as beliefs regarding FGM, and its association with HCV infections.

5e. Conclusion

Prevention efforts need to be designed based on specific characteristics such as women with less education and rural neighborhoods. Similarly, prevention efforts need to be implemented with cultural sensitivity; educating religious leaders about the harmful effects of FGM may provide an efficient means of bringing the practice to an end. The Ministry of Health Program in Egypt institutes two programs for HCV; the first program aims at providing treatment for those already infected with HCV(Yahia, 2011). The second program facilitates prevention efforts. Re-directing funds towards prevention programs, in addition to ongoing treatment of infected individuals is the most effective means of reducing the burden of HCV in Egypt. The results of this study help provide

useful insights to public health professionals to design and implement programs that are efficient in preventing HCV transmission in Egypt.

References:

Abdel-Wahab, M. F., Zakaria, S., Kamel, M., Abdel-Khaliq, M., Mabrouk, M. A., Salama, H., . . . Strickland, G. T. (1994). High seroprevalence of hepatitis C infection among risk groups in Egypt. *The American journal of tropical medicine and hygiene, 51*(5), 563.

Abdel-Aziz, F., Habib, M., Mohamed, M. K., Abdel-Hamid, M., Gamil, F., Madkour, S., . . . Strickland, G. T. (2000). Hepatitis C virus (HCV) infection in a community in the Nile Delta: population description and HCV prevalence. *Hepatology, 32*(1), 111-115.

Alter, M. J. (1997). Epidemiology of hepatitis C. *Hepatology, 26*(S3), 62S-65S.

ANNEMARIE WASLEY, S. D., & Alter, M. J. (2000). *Epidemiology of hepatitis C: geographic differences and temporal trends.* Paper presented at the Hepatitis C: State of the Art at the Millennium: A Bound Compilation of Issues 1 and 2 of Seminars in Liver Disease (2000).

Arafa, N., Hoseiny, M. E., Rekacewicz, C., Bakr, I., El-Kafrawy, S., Daly, M. E., . . . Fontanet, A. (2005). Changing pattern of hepatitis C virus spread in rural areas of Egypt. *Journal of hepatology, 43*(3), 418-424.

Assaad, M. B. (1980). Female circumcision in Egypt: Social implications, current research, and prospects for change. *Studies in Family Planning*, 3-16.

Bakr, I., Rekacewicz, C., El Hosseiny, M., Ismail, S., El Daly, M., El-Kafrawy, S., . . . Fontanet, A. (2006). Higher clearance of hepatitis C virus infection in females compared with males. *Gut, 55*(8), 1183-1187.

Ben-Shlomo, Y., & Kuh, D. (2002). A life course approach to chronic disease epidemiology: conceptual models, empirical challenges and interdisciplinary perspectives. *International journal of Epidemiology, 31*(2), 285-293.

Chisari, F. V. (2005). Unscrambling hepatitis C virus–host interactions. *Nature, 436*(7053), 930-932.

Control, C. f. D., & Prevention. (1998). Recommendations for prevention and control of hepatitis C virus (HCV) infection and HCV-related chronic disease: US Department of Health and Human Services, Centers for Disease Control and Prevention.

Diouf, K., & Nour, N. (2012). Female Genital Cutting and HIV Transmission: Is There an Association? *American Journal of Reproductive Immunology*.

Eberhardt, M. S., & Pamuk, E. R. (2004). The importance of place of residence: examining health in rural and nonrural areas. *Journal Information, 94*(10).

El-Gibaly, O., Ibrahim, B., Mensch, B. S., & Clark, W. H. (2002). The decline of female circumcision in Egypt: evidence and interpretation. *Social science & medicine, 54*(2), 205-220.

El-Zanaty, F. a. A. W. (2009). *Egypt Demographic And Health Survey 2008*.

Fatma El-Zanaty, A. W. (2008). DHS Final Reports. *Egypt DHS, 2008 - Final Report*

Frank, C., Mohamed, M. K., Strickland, G. T., Lavanchy, D., Arthur, R. R., Magder, L. S., . . . Anwar, W. (2000). The role of parenteral antischistosomal therapy in the spread of hepatitis C virus in Egypt. *The Lancet, 355*(9207), 887-891.

Gibb, D., Goodall, R., Dunn, D., Healy, M., Neave, P., Cafferkey, M., & Butler, K. (2000). Mother-to-child transmission of hepatitis C virus: evidence for preventable peripartum transmission. *The Lancet, 356*(9233), 904-907.

Gumber, S. C., & Chopra, S. (1995). Hepatitis C: a multifaceted disease. Review of extrahepatic manifestations. *Annals of internal medicine, 123*(8), 615.

Habib, M., Mohamed, M. K., Abdel-Aziz, F., Magder, L. S., Abdel-Hamid, M., Gamil, F., . . . Strickland, G. T. (2003). Hepatitis C virus infection in a community in the Nile Delta: risk factors for seropositivity. *Hepatology, 33*(1), 248-253.

Hagan, H., Thiede, H., Weiss, N. S., Hopkins, S. G., Duchin, J. S., & Alexander, E. R. (2001). Sharing of drug preparation equipment as a risk factor for hepatitis C. *American journal of public health, 91*(1), 42.

Hall, A. J., Yee, L. J., & Thomas, S. L. (2002). Life course epidemiology and infectious diseases. *International journal of epidemiology, 31*(2), 300-301.

Hibbs, R., Corwin, A., Hassan, N., Kamel, M., Darwish, M., Edelman, R., . . . Mokhtar, S. (1993). The epidemiology of antibody to hepatitis C in Egypt. *Journal of Infectious Diseases, 168*(3), 789-790.

Hoofnagle, J. H. (2003). Hepatitis C: the clinical spectrum of disease. *Hepatology, 26*(S3), 15S-20S.

Kamal, S., El Tawil, A., Nakano, T., He, Q., Rasenack, J., Hakam, S., . . . Madwar, M. A. (2005). Peginterferon α-2b and ribavirin therapy in chronic hepatitis C genotype 4: impact of treatment duration and viral kinetics on sustained virological response. *Gut, 54*(6), 858-866.

Kamili, S., Drobeniuc, J., Araujo, A. C., & Hayden, T. M. (2012). Laboratory diagnostics for hepatitis C virus infection. *Clinical infectious diseases, 55*(suppl 1), S43-S48.

Khalifa, A., Mitchell, B. S., Watts, D. M., El-Samahy, M. H., & El-Sayed, M. H. (1993). Prevalence of hepatitis C viral antibody in transfused and nontransfused Egyptian children: DTIC Document.

Kouba, L. J., & Muasher, J. (1985). Female circumcision in Africa: an overview. *African Studies Review, 28*(1), 95-110.

Lavanchy, D. (2009). The global burden of hepatitis C. *Liver International, 29*(s1), 74-81.

Lleras-Muney, A. (2005). The relationship between education and adult mortality in the United States. *The Review of Economic Studies, 72*(1), 189-221.

Lynch, S. M. (2003). Cohort and life-course patterns in the relationship between education and health: A hierarchical approach. *Demography, 40*(2), 309-331.

Magder, L. S., Fix, A. D., Mikhail, N. N., Mohamed, M. K., Abdel-Hamid, M., Abdel-Aziz, F., . . . Strickland, G. T. (2005). Estimation of the risk of transmission of hepatitis C between spouses in Egypt based on seroprevalence data. *International journal of epidemiology, 34*(1), 160-165.

Maslovskaya, O., Brown, J. J., & Padmadas, S. S. (2009). Disentangling the complex association between female genital cutting and HIV among Kenyan women. *Journal of biosocial science, 41*(6), 815.

McGee, P. A., Cupell, L. G., Higgins, M. M., Renshaw, M. D., & Shaver, E. R. (2001). Updated US Public Health Service guidelines for the management of occupational exposures to HBV, HCV, and HIV and recommendations for postexposure prophylaxis.

Medhat, A., Shehata, M., Magder, L. S., Mikhail, N., Abdel-Baki, L., Nafeh, M., . . . Fix, A. D. (2002). Hepatitis c in a community in Upper Egypt: risk factors for infection. *The American journal of tropical medicine and hygiene, 66*(5), 633-638.

Meinardus, O. (1967). Mythological, historical and sociological aspects of the practice of female circumcision among the Egyptians. *Acta Ethnographica Academiae Scientiarum Hungaricae, 16*, 387-397.

Memon, M., & Memon, M. (2002). Hepatitis C: an epidemiological review. *Journal of Viral Hepatitis, 9*(2), 84-100.

Mok, J., Pembrey, L., Tovo, P.-A., & Newell, M.-L. (2005). When does mother to child transmission of hepatitis C virus occur? *Archives of Disease in Childhood-Fetal and Neonatal Edition, 90*(2), F156-F160.

Momoh, C., Ladhani, S., Lochrie, D. P., & Rymer, J. (2001). Female genital mutilation: analysis of the first twelve months of a southeast London specialist clinic. *British Journal of Obstetrics and Gynaecology, 108*(2), 186-191.

Pawlotsky, J. M. (2004). Pathophysiology of hepatitis C virus infection and related liver disease. *Trends in microbiology, 12*(2), 96-102.

Piazza, M., Borgia, G., Picciotto, L., Nappa, S., Cicciarello, S., & Orlando, R. (1995). Detection of hepatitis C virus-RNA by polymerase chain reaction in dental surgeries. *Journal of medical virology, 45*(1), 40-42.

Poynard, T., Bedossa, P., & Opolon, P. (1997). Natural history of liver fibrosis progression in patients with chronic hepatitis C. *The Lancet, 349*(9055), 825-832.

Prati, D. (2006). Transmission of hepatitis C virus by blood transfusions and other medical procedures: a global review. *Journal of hepatology, 45*(4), 607-616.

Saeed, A., al Admawi, A., al Rasheed, A., Fairclough, D., Bacchus, R., Ring, C., & Garson, J. (1991). Hepatitis C virus infection in Egyptian volunteer blood donors in Riyadh. *Lancet, 338*(8764), 459-460.

Sayed, G., El-Aty, M., & Fadel, K. (1996). The practice of female genital mutilation in Upper Egypt. *International Journal of Gynecology & Obstetrics, 55*(3), 285-291.

Seeff, L. B. (2006). Natural history of chronic hepatitis C. *Hepatology, 36*(S1), S35-S46.

Shell-Duncan, B. (2001). The medicalization of female "circumcision": harm reduction or promotion of a dangerous practice? *Social Science & Medicine, 52*(7), 1013-1028.

Shepard, C. W., Finelli, L., & Alter, M. J. (2005). Global epidemiology of hepatitis C virus infection. *The Lancet infectious diseases, 5*(9), 558-567.

Singh, S., Dwivedi, S., Sood, R., & Wali, J. (2000). Hepatitis B, C and human immunodeficiency virus infections in multiply-injected kala-azar patients in Delhi. *Scandinavian journal of infectious diseases, 32*(1), 3-6.

Slack, A. T. (1988). Female circumcision: A critical appraisal. *Human Rights Quarterly, 10*(4), 437-486.

Stoszek, S. K., Abdel-Hamid, M., Narooz, S., Daly, M. E., Saleh, D. A., Mikhail, N., . . . Said, A. (2006). Prevalence of and risk factors for hepatitis C in rural pregnant Egyptian women. *Transactions of the Royal Society of Tropical Medicine and Hygiene, 100*(2), 102-107.

Strickland, G. T. (2006). Liver disease in Egypt: hepatitis C superseded schistosomiasis as a result of iatrogenic and biological factors. *Hepatology, 43*(5), 915-922.

Thorpe, L. E., Ouellet, L. J., Hershow, R., Bailey, S. L., Williams, I. T., Williamson, J., . . . Garfein, R. S. (2002). Risk of hepatitis C virus infection among young adult injection drug users who share injection equipment. *American journal of epidemiology, 155*(7), 645-653.

Toubia, N. (1994). Female circumcision as a public health issue. *New England Journal of Medicine, 331*(11), 712-716.

Ugboma, H., Akani, C., & Babatunde, S. (2004). Prevalence and medicalization of female genital mutilation. *Nigerian journal of medicine: journal of the National Association of Resident Doctors of Nigeria, 13*(3), 250.

Wiens, J. (1996). Female circumcision is curbed in Egypt. *BMJ (Clinical research ed.), 313*(7052), 249.

Yahia, M. (2011). Global health: a uniquely Egyptian epidemic. *Nature, 474*(7350), S12-S13.